UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

September 20, 1993

Reply To
Attn Of: HW-124

MEMORANDUM

SUBJECT: INEL WAG 7 RWMC Pit 9 Interim Action - Development of Delisting Levels

FROM: MJ Nearman, RPM
Federal Facilities Section I

THRU: Catherine Massimino
Hazardous Waste Director's Office

TO: File

This memorandum outlines the approach used to determine delisting levels for INEL WAG 7 RWMC Pit 9 listed wastes. Procedures used for determining delisting levels are consistent with 40 CFR 260.20 and 260.22 and with current EPA guidance, specifically: (1) Use of EPACML for Delisting, undated; (2) Docket Report on Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 and §260.22, July 1992; and (3) A Guide to Delisting of RCRA Wastes for Superfund Remedial Responses, OSWER Superfund Publication 9347.3-09FS, September 1990. These references are included here as Attachments 1 through 3.

Listed wastes present in Pit 9 were identified through historical process information and inventory records for wastes disposed of in the pit during its operation from November 1967 to June 1969. Six listed wastes have been identified in the Pit 9 wastes: 1,1,1-trichloroethane, sodium cyanide, and potassium cyanide. Additional information on Pit 9, including a summary of site characteristics, is included in the Record of Decision (Attachment 4).

The pit consists of approximately 250,000 ft^3 of clean overburden, 150,000 ft^3 of packaged waste, and 350,000 ft^3 of interstitial soil. Approximately 500,000 ft^3 of soil and other material in Pit 9 are estimated to be contaminated with RCRA hazardous waste and TRU radionuclides. It is estimated that 250,000 ft^3 of material contains $\leq$ 10 nCi/g TRU and would not undergo treatment. This material would not be removed from the area of contamination. Materials $\leq$ 10 nCi/g would remain in the

pit consistent with current Low Level Waste disposal practices at the INEL.

Given this, approximately 250,000 ft^3 are expected to undergo treatment. A portion of the treatment residual (i.e., that which is $\leq$ 10 nCi/g) would be delisted and returned to the pit. The concentrated waste residual (i.e., that which is > 10 nCi/g) would not be delisted and would be stored onsite pending final disposal.

To determine a reasonably conservative Dilution/Attenuation Factor (DAF), it was assumed that 250,000 ft^3 (9259 yd^3) would require delisting. Table 1 of the reference Use of EPACML for Delisting cites a DAP of 36 for a waste volume of 10,000 yd^3 per year. Note that the delisting levels determined here assume that the waste stream will be generated for 20 years (i.e., 200,000 yd^3 total to be generated and delisted); the 250,000 ft^3 of Pit 9 waste is an estimate of the total volume to be delisted. Therefore, the use of a DAF = 36 is believed to be conservative. The assumptions used to support the delisting levels are included here as Attachment 5.

Attachments

cc: Wayne Pierre, EPA

USE OF EPACML FOR DELISTING

For a delisting decision-making, EPA (or Agency) often uses appropriate fate and transport models and waste-specific information (e.g., waste volume and constituent concentration data) to predict the impact of a petitioned waste on human health and the environment. In selecting appropriate models, the Agency chooses a reasonable worst-case waste management scenario for the petitioned waste and considers plausible exposure routes. The Agency typically considers waterborne dispersal (via ground water and surface water routes) and airborne dispersal of waste contaminants.

If disposal in a landfill is the most reasonable, worst-case management scenario for the petitioned waste, the major exposure route of concern for hazardous constituents present in the waste would be ingestion of contaminated ground water. The Agency recently used the modified EPA's Composite Model for Landfills (EPACML) that mathematically simulates the movement of contaminants from a Subtitle D waste management unit and migration through the subsurface environment to a potential drinking-water well. The EPACML, which includes both unsaturated and saturated zone transport modules, estimates the dilution/attenuation factor (DAF) resulting from subsurface processes (dispersion, dilution, sorption, etc.). See 56 FR 32993 (July 18, 1991) and 56 FR 67197 (December 30, 1991) for a detailed description of the EPACML, the disposal assumptions, and the modifications made for delisting.

COMPLIANCE-POINT CONCENTRATIONS

Typically, the Agency uses the maximum estimated waste volume and the maximum reported leachate concentrations as inputs into the EPACML to estimate the constituent concentrations in the ground water at a potential receptor well (referred to as a compliance point) downgradient from the disposal site. The calculated compliance-point concentrations are then compared with the levels of regulatory concern (see "Docket Report on Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §§260.20 and 260.22"). If the compliance-point concentrations exceed the corresponding health-based levels (HBLs), then the waste has the potential to contaminate the ground water at levels of regulatory concern and is not likely to be a candidate for delisting.

The following presents a step-by-step description of the use of EPACML DAFs for the evaluation of wastes generated on an ongoing basis that may be placed in a landfill.

Example: A facility generates 15,000 cubic yards/year of electroplating waste (F006). TCLP data are provided and must be evaluated based on a reasonable worst-case scenario, i.e., disposal in an unlined Subtitle D landfill.

Step 1. Determine the maximum annual waste volume, in cubic yards/year.

Example: 15,000 cubic yards/year

Step 2. Refer to Table 1 for DAF value corresponding to the maximum annual volume.

Example: DAF = 29 for 15,000 cubic yards/year of landfilled waste

Step 3. Summarize the maximum leachate concentrations for hazardous constituents of concern based on analytical results and/or other pertinent data.

Example:

Constituents	Maximum TCLP Leachate Concentrations (mg/l)
Arsenic	0.88
Barium	5.0
Beryllium	0.015
Cadmium	0.09
Chromium	2.0
Cyanide	2.3
Lead	0.25
Mercury	0.02
Nickel	1.9
Selenium	0.64

Step 4. Divide the maximum leachate concentrations (Step 3) by the DAF value to calculate the compliance-point concentrations, and compare the results with the levels of regulatory concern.

Table 1

DILUTION/ATTENUATION FACTORS (DAFs) FOR LANDFILLS USED IN THE EVALUATION OF DELISTING PETITIONS

Waste Volume (cubic Yards per Year)	DAF at 95% Percentile
1,000	100*
1,250	96
1,500	90
1,750	84
2,000	79
2,500	74
3,000	68
4,000	57
5,000	54
6,000	48
7,000	45
8,000	43
9,000	40
10,000	36
12,500	33
15,000	29
20,000	27
25,000	24
30,000	23
40,000	20
50,000	19
60,000	17
80,000	17
90,000	16
100,000	15
150,000	14
200,000	13
250,000	12
300,000	12
350,000	11
400,000	10

* DAF cutoff is 100 corresponding to the Toxicity Characteristic Rule.

Example:

Constituent	Compliance-Point Concentrations (mg/l)	Health-Based Levels (mg/l)*
Arsenic	0.03	0.05
Barium	0.17	2.0
Beryllium	0.0005	0.004
Cadmium	0.0031	0.005
Chromium	0.069	0.1
Cyanide	0.079	0.2
Lead	0.0086	0.015
Mercury	0.0007	0.002
Nickel	0.066	0.1
Selenium	0.022	0.05

* The health-based levels contained in "Docket Report on Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §§260.20 and 260.22" are updated periodically to stay consistent with the latest drinking water standards, risk information, and toxicologic data.

Step 5. Based on the analysis in Step 4, determine whether the waste is delistable.

Example: All the compliance-point concentrations are below the respective health-based levels. Therefore, the petitioned waste would qualify for delisting.

The Agency intends to evaluate petitions for wastes no longer being generated (i.e., petitions for one-time exclusions) on a case-by-case basis. The DAFs in Table 1 were calculated by assuming an ongoing process generates wastes for 20 years. Therefore, the DAF may need to be adjusted as appropriate to account for one-time exclusions.

DELISTING LEVELS

Some exclusions are conditional and require verification testing on batches of delisted wastes prior to disposal. The Agency generally establishes the maximum delisting levels for hazardous constituents of concern by back-calculating from the health-based levels through the use of appropriate models. In most cases, adequate leachate data can be obtained from extraction analyses (e.g., TCLP); therefore, the Agency typically develops the delisting levels in terms of the maximum allowable leachate concentrations (MALs) in the following manner: MAL = HBL x DAF.

Example: For a maximum waste generation of 15,000 cubic yards per year, Table 1 yields a DAF of 29. Using the current HBL of 0.005 mg/l for cadmium, the maximum allowable leachate concentration for cadmium is 0.005 mg/l x 29 = 0.15 mg/l.

In addition, in cases where extraction of organic constituents from certain complex matrixes is deemed inappropriate, the Agency has applied the Organic Leachate Model (OLM) to further back-calculate from MALs to derive the maximum allowable total concentrations. This yields MALs in the waste generated, rather than in the TCLP leachate. The OLM correlates the mobility of constituents present in the waste with total constituent levels (see 50 FR 48953, November 27, 1985, and 51 FR 41084, November 13, 1986). The following steps describe the use of the OLM for such back-calculation in detail:

Step 1. Calculate the maximum allowable leachate concentrations (MAL = HBL x DAF).

Example:

The DAF for a maximum waste volume of 15,000 cubic yards/year is 29, and the HBL for dinitrotoluene is 5×10^{-5} mg/l. Thus, MAL = (5×10^{-5} mg/l) x 29 = 0.00145 mg/l.

Step 2. The OLM equation is:

$$C_1 = 0.00211 C_w^{0.678} S^{0.373}$$

where C_1 = concentration of constituent in leachate (mg/l)
C_w = total constituent concentration
S = water solubility of constituent (mg/l)

Rearrange this equation for back-calculation; i.e., change the OLM equation into the natural-logarithm form:

$$\ln C_1 = \ln 0.00211 + 0.678 \ln C_w + 0.373 \ln S$$

Step 3. Given C_1 = MAL = DAF x HBL, the equation becomes:

$$\ln MAL = -6.1611 + 0.678 \ln C_w + 0.373 \ln S$$

Therefore, the equation can be converted into maximum allowable total concentration, C_w:

$$C_w = e^{((\ln MAL + 6.1611 - 0.373 \ln S)/0.678)}$$

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.005 mg/l = C_1

5.47 = C_w

Example:

Given the information in the example in Step 1 and $S = 1.32 \times 10^3$ mg/l, the maximum allowable total concentration for dinitrotoluene is:

$$C_w = e^{((\ln 0.00145 + 6.1611 - 0.373 \ln 1320)/0.678)}$$
$$= 0.011 \text{ ppm}$$

Docket Report on Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 and §260.22

July 1992

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The Delisting Section, in its review of delisting petitions, evaluates levels of carcinogens and systemic toxicants listed in Appendices VII and VIII of 40 CFR §261 and Appendix IX of 40 CFR §264. The exposure assumption that is used to assess the hazard of a petitioned waste is ingestion of contaminated ground water, leachate, or wastewater. For both carcinogens and systemic toxicants, the water intake assumption is 2 liters per day for an average 70 kg adult over a 70-year lifetime. The use of a 70-year lifetime considers the effects of carcinogens as a function of cumulative doses, rather than doses received by any small subsection of the population. In cases where constituents are known to be both carcinogens and systemic toxicants, the more conservative carcinogenic slope factor takes precedence over the verified or unverified toxicant reference dose.

The following equation is used to calculate the delisting health-based levels for carcinogens:

$$D_c = \frac{(R \times W \times LT)}{(CSF \times I \times A \times ED)}$$

where:

- D_c = delisting health-based level for carcinogen (mg/l)
- R = assumed risk level = 10^{-6}
- W = body weight = 70 kg
- LT = assumed lifetime = 70 years
- CSF = carcinogenic slope factor = experimental potency $(mg/kg/day)^{-1}$
- I = intake assumption = 2 L/day
- A = absorption factor = 1
- ED = exposure duration = 70 years

The following equation is used to calculate the delisting health-based levels for systemic toxicants:

$$D_s = \frac{(RfD \times W)}{(I \times A)}$$

where: D_s = delisting health-based level for systemic toxicant (mg/l)

ΔRfD = reference dose (mg/kg/day)

W = body weight = 70 kg

I = intake assumption = 2 L/day

A = absorption factor = 1

Constituents which have verified health-based levels are listed on the EPA's Integrated Risk Information System (IRIS), which is maintained by the Office of Health and Environmental Assessment in the Office of Research and Development. The information listed on IRIS is designed to be a guide for the evaluation of potential health problems, and is included on IRIS only after an intra-office work group of EPA toxicologists and other scientists have reviewed the facts. IRIS provides verified information for oral and/or inhalation reference doses, risk estimates for carcinogenicity, drinking water health advisories, risk management summaries, and other supplemental data. (IRIS provides the carcinogenic slope factors and the reference doses that are needed in the previous equations.) IRIS is currently available on the National Library of Medicine's TOXNET system. The general public can access TOXNET through the NLM directly, TYMNET, SPRINTNET, COMPUSERVE or NLM/TYMNET. Hard copies of IRIS information for all constituents with verified delisting health-based levels will be provided by the Delisting Section upon request.

In addition, IRIS provides Maximum Contaminant Levels (MCLs) for constituents. MCLs are promulgated under the Safe Drinking Water Act (SDWA) of 1974, as amended in 1986, and consider technology and economic feasibility as well as health effects. Finalized MCLs are used as the delisting levels for carcinogens and systemic toxicants when available. Proposed MCLs are used as delisting levels for carcinogens and systemic toxicants when finalized MCLs are not available.

Some of the constituents on the delisting docket report entitled "Docket Report on Health-Based Levels and Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 and §260.22" are not on IRIS. In these cases, other references, such as health and environmental effects documents (HEEDs), Office of Drinking Water (ODW) health advisories, Carcinogen Assessment Group (CAG) profiles, Health Effects Assessment Summary

Tables (HEASTs), and various chemical files are used and will be provided by the Delisting Section upon request. The same equations presented above are used for calculating delisting levels from unverified health-based levels.

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l), (in H_2O at 25°C)	Ref.
83 32 9	Acenaphthene	2	4	3.42	6
67 64 1	Acetone	4	4	1.0×10^{6}	6
75 05 8	Acetonitrile	2×10^{-1}	4	1.0×10^{6}	6
98 86 2	Acetophenone	4	4	5.5×10^{3}	15
107 02 8	Acrolein	7×10^{-1}	45	5×10^{5}	2
79 06 1	Acrylamide	Treatment Technique	42	$>1 \times 10^{6}$	15
107 13 1	Acrylonitrile	6×10^{-5}	5	7.9×10^{4}	6
309 00 2	Aldrin	2×10^{-6}	5	1.8×10^{-1}	6
62 53 3	Aniline (Benzeneamine)	6×10^{-3}	5	3.5×10^{4}	2
7440 36 0	Antimony	6×10^{-3}	27		
140 57 8	Aramite	1×10^{-3}	5		
7440 38 2	Arsenic	5×10^{-2}	13		
7440 39 3	Barium	2	19		
56 55 3	Benz(a)anthracene	1×10^{-4}	43	5.7×10^{-3}	6
71 43 2	Benzene	5×10^{-3}	14	1.75×10^{3}	6
92 87 5	Benzidine	2×10^{-7}	5	4.0×10^{2}	6
50 32 8	Benzo(a)pyrene	2×10^{-4}	27	1.2×10^{-3}	6
205 99 2	Benzo(b)fluoranthene	2×10^{-4}	43	1.4×10^{-2}	6
100 51 6	Benzyl alcohol	1×10^{1}	45	4×10^{4} (17°C)	15
100 44 7	Benzyl chloride	2×10^{-4}	5	3.3×10^{3}	6
7440 41 7	Beryllium	4×10^{-3}	27		
111 44 4	Bis(2-chloroethyl)ether	3×10^{-5}	5	1.02×10^{4}	6
108 60 1	Bis(2-chloroisopropyl ether)	5×10^{-4}	45	1.7×10^{3}	6
117 81 7	Bis(2-ethylhexyl)phthalate	6×10^{-3}	27	4×10^{-1}	11
75 27 4	Bromodichloromethane	3×10^{-4}	5	4.7×10^{3} (22°C)	22
74 83 9	Bromomethane	5×10^{-2}	4	1.0×10^{3}	18
85 68 7	Butyl benzyl phthalate	1×10^{-1}	27	2.9	10
88 85 7	2-sec-Butyl-4,6-dinitrophenol (Dinoseb)	7×10^{-3}	27	5×10^{1}	6
7440 43 9	Cadmium	5×10^{-3}	42		
75 15 0	Carbon disulfide	4	4	2.94×10^{3}	6
56 23 5	Carbon tetrachloride	5×10^{-3}	14	7.57×10^{2}	6
57 74 9	Chlordane	2×10^{-3}	42	5.6×10^{-1}	6
106 47 8	p-Chloroaniline	1×10^{-1}	4	3.9×10^{3}	24
108 90 7	Chlorobenzene	1×10^{-1}	42	4.66×10^{2}	6
510 15 6	Chlorobenzilate	7×10^{-1}	4	1×10^{4}	1

**Unverified health-based levels

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
126 99 8	2-Chloro-1,3-butadiene (Chloroprene)	$7x10^{-1}$	45	$3x10^{2}$	1
124 48 1	Chlorodibromomethane	$4x10^{-4}$	45	$4.4x10^{3}$(22°C)	22
67 66 3	Chloroform	$6x10^{-3}$	5	$8.2x10^{3}$	6
95 57 8	2-Chlorophenol	$2x10^{-1}$	4	$2.85x10^{4}$(20°C)	15
107 05 1	3-Chloropropene (Allyl chloride)	$2x10^{-3}$	36	$1x10^{2}$	15
7440 47 3	Chromium	$1x10^{-1}$	42		
218 01 9	Chrysene	$2x10^{-4}$	43	$1.8x10^{-3}$	6
319 77 3	Cresols	2	4	$3.1x10^{4}$	6
57 12 5	Cyanide	$2x10^{-1}$	27		
94 75 7	2,4-Dichlorophenoxyacetic Acid (2,4-D)	$7x10^{-2}$	42	$8.9x10^{2}$	6
72 54 8	DDD	$1x10^{-4}$	5	$1x10^{-1}$	6
72 55 9	DDE	$1x10^{-4}$	5	$4x10^{-2}$	6
50 29 3	DDT	$1x10^{-4}$	5	$5x10^{-3}$	6
2303 16 4	Diallate	$6x10^{-4}$	45	$1.4x10^{1}$	6
53 70 3	Dibenz(a,h)anthracene	$3x10^{-4}$	43	$5.0x10^{-4}$	6
96 12 8	1,2-Dibromo-3-chloropropane	$2x10^{-4}$	42	$1.0x10^{3}$	6
74 95 3	Dibromomethane	$4x10^{-1}$	45	$1.3x10^{4}$	25
84 74 2	Di-n-butyl phthalate	4	4	$1.3x10^{1}$	6
95 50 1	1,2-Dichlorobenzene	$6x10^{-1}$	42	$1.0x10^{2}$	6
106 46 7	1,4-Dichlorobenzene	$7.5x10^{-2}$	14	$7.9x10^{1}$	6
91 94 1	3,3'-Dichlorobenzidine	$8x10^{-5}$	5	4	6
75 71 8	Dichlorodifluoromethane	7	4	$2.8x10^{2}$	6
75 34 3	1,1-Dichloroethane	4	45	$5.5x10^{3}$	6
107 06 2	1,2-Dichloroethane	$5x10^{-3}$	14	$8.52x10^{3}$	6
75 35 4	1,1-Dichloroethylene	$7x10^{-3}$	14	$2.25x10^{3}$	6
156 59 2	cis-1,2-Dichloroethylene	$7x10^{-2}$	42	$3.5x10^{3}$	6
156 60 5	trans-1,2-Dichloroethylene	$1x10^{-1}$	42	$6.3x10^{3}$	6
75 09 2	Dichloromethane	$5x10^{-3}$	27	$2.0x10^{4}$	6
120 83 2	2,4-Dichlorophenol	$1x10^{-1}$	4	$4.6x10^{3}$	6
78 87 5	1,2-Dichloropropane	$5x10^{-3}$	42	$2.7x10^{3}$	6
542 75 6	1,3-Dichloropropene	$2x10^{-4}$	45	$2.8x10^{3}$	6
60 57 1	Dieldrin	$2x10^{-6}$	5	$1.95x10^{-1}$	6
84 66 2	Diethyl phthalate	$3x10^{1}$	4	$8.96x10^{2}$	6
56 53 1	Diethylstilbesterol	$7x10^{-9}$	45	$1.3x10^{4}$	15
60 51 5	Dimethoate	$7x10^{-3}$	4	$2.5x10^{4}$	6

**Unverified health-based levels

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l). (in H_2O at 25°C)	Ref.
119 90 4	3,3'-Dimethoxybenzidine	$3x10^{-3}$	45	$2x10^{3}$	1,23
119 93 7	3,3'-Dimethylbenzidine	$4x10^{-6}$	45	$7x10^{1}$	1,23
57 97 6	7,12-Dimethylbenz(a)-anthracene	$1x10^{-6}$	20	$4.4x10^{-3}$	6
105 67 9	2,4-Dimethylphenol	$7x10^{-1}$	4	$5.9x10^{2}$	9
131 11 3	Dimethyl phthalate	$4x10^{2}$	45	$4.3x10^{3}$	2
99 65 0	1,3-Dinitrobenzene	$4x10^{-3}$	4	$4.7x10^{2}$	6
51 28 5	2,4-Dinitrophenol	$7x10^{-2}$	4	$5.6x10^{3}$	6
121 14 2	Dinitrotoluene	$5x10^{-5}$	5,21	$1.32x10^{3}$	6
117 84 0	Di-n-octyl phthalate	$7x10^{-1}$	45	3	22
123 91 1	1,4-Dioxane	$3x10^{-3}$	5	$4.31x10^{5}$	6
122 39 4	Diphenylamine	$9x10^{-1}$	4	$5.76x10^{1}$	6
122 66 7	1,2-Diphenylhydrazine	$4x10^{-5}$	5	$1.84x10^{3}$	6
298 04 4	Disulfoton	$1x10^{-3}$	4	$2.5x10^{1}$	24
115 29 7	Endosulfan	$2x10^{-3}$	4	$5.3x10^{-1}$	22
72 20 8	Endrin	$2x10^{-3}$	27	$2.5x10^{-1}$	22
106 89 8	Epichlorohydrin (1-Chloro-2,3-epoxypropane)	Treatment Technique	42	$6.0x10^{4}$	6
110 80 5	2-Ethoxy ethanol	$1x10^{1}$	45	$1x10^{5}$	1
100 41 4	Ethyl benzene	$7x10^{-1}$	42	$1.52x10^{2}$	6
60 29 7	Ethyl ether	7	4	$6.05x10^{4}$	12,2
106 93 4	Ethylene dibromide	$5x10^{-5}$	42	$4.3x10^{3}$	6
97 63 2	Ethyl methacrylate	3	45	$7x10^{2}$	1,6
62 50 0	Ethyl methanesulfonate	$1x10^{-6}$	28	$3.69x10^{5}$	6
52 85 7	Famphur	$1x10^{-3}$	41	$1.43x10^{2}$	15
206 44 0	Fluoranthene	1	4	$2.06x10^{-1}$	6
86 73 7	Fluorene	1	4	1.69	6
16984 48 8	Fluoride	4	39		
64 18 6	Formic acid	$7x10^{1}$	45	$1x10^{6}$	6
76 44 8	Heptachlor	$4x10^{-4}$	42	$1.8x10^{-1}$	6
1024 57 3	Heptachlor epoxide (alpha, beta, gamma isomers)	$2x10^{-4}$	42	$3.5x10^{-1}$	6
118 74 1	Hexachlorobenzene	$1x10^{-3}$	27	$6.0x10^{-3}$	6

**Unverified health-based levels

HEALTH-BASED LEVELS AND SOLUBILITIES FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS

July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l) (in H_2O at 25°C)	Ref.
87 68 3	Hexachlorobutadiene	$4x10^{-4}$	5	$1.5x10^{-1}$	6
77 47 4	Hexachlorocyclopentadiene	$5x10^{-2}$	27	2.1	6
67 72 1	Hexachloroethane	$3x10^{-3}$	5	$5.0x10^{1}$	6
70 30 4	Hexachlorophene	$1x10^{-2}$	4	$4x10^{-3}$	6
319 84 6	alpha-HCH	$6x10^{-6}$	5	1.63	6
319 85 7	beta-HCH	$2x10^{-5}$	5	$2.4x10^{-1}$	6
193 39 5	Indeno(1,2,3,cd)pyrene	$4x10^{-4}$	43	$5.3x10^{-4}$	6
78 83 1	Isobutanol	$1x10^{1}$	4	$7.6x10^{4}$	3
78 59 1	Isophorone	$9x10^{-3}$	5	$1.2x10^{4}$	15
143 50 0	Kepone	$2x10^{-6}$	29	7.6 (24°C)	15
7439 92 1	Lead	$1.5x10^{-2}$	44		
58 89 9	Lindane (gamma-HCH)	$2x10^{-4}$	42	7.8	6
7439 97 6	Mercury	$2x10^{-3}$	42		
126 98 7	Methacrylonitrile	$4x10^{-3}$	4	$2.5x10^{4}$	15
67 56 1	Methanol	$2x10^{1}$	4	$>1x10^{6}$	1
72 43 5	Methoxychlor	$4x10^{-2}$	42	$4x10^{-2}$(24°C)	24
74 87 3	Methyl chloride	$3x10^{-3}$	45	$6.5x10^{3}$	6
56 49 3	3-Methylcholanthrene	$1x10^{-6}$	30		
78 93 3	Methyl ethyl ketone	2	45	$2.68x10^{5}$	6
108 10 1	Methyl isobutyl ketone	2	45	$1.91x10^{4}$	2
80 62 6	Methyl methacrylate	3	45	$2.0x10^{1}$	6
298 00 0	Methyl parathion	$9x10^{-3}$	4	$6x10^{1}$	6
91 20 3	Naphthalene	1	45	$3.4x10^{1}$	15
91 59 8	2-Naphthylamine	$4x10^{-5}$	31	$5.86x10^{2}$	6
7440 02 0	Nickel	$1x10^{-1}$	27		
98 95 3	Nitrobenzene	$2x10^{-2}$	4	$1.9x10^{3}$	6
79 46 9	2-Nitropropane	$4x10^{-6}$	26	$1.7x10^{5}$	38
924 16 3	N-Nitroso-di-n-butylamine	$6x10^{-6}$	5	$6.7x10^{3}$	1,3
55 18 5	N-Nitrosodiethylamine	$2x10^{-7}$	5	$4.1x10^{5}$	1,3
62 75 9	N-Nitrosodimethylamine	$7x10^{-7}$	5	$2x10^{2}$	1
156 10 5	N-Nitrosodiphenylamine	$7x10^{-3}$	5	$4.0x10^{1}$	10
621 64 7	N-Nitrosodi-n-propylamine	$5x10^{-6}$	5	$9.9x10^{3}$	1
10595 95 6	N-Nitrosomethylethylamine	$2x10^{-6}$	5	$2x10^{4}$	1
100 75 4	N-Nitrosopiperidine	$8x10^{-6}$	32	$>1x10^{6}$	6
930 55 2	Nitrosopyrrolidine	$2x10^{-5}$	5	$>1x10^{6}$	6

**Unverified health-based levels

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l), (in H_2O at 25°C)	Ref.
152 16 9	Octamethyl pyrophosphoramide	$7x10^{-2}$	45	$>1x10^{6}$	1
56 38 2	Parathion	$2x10^{-1}$	45	$2.4x10^{1}$ (20°C)	15
608 93 5	Pentachlorobenzene	$3x10^{-2}$	4	$1.35x10^{-1}$	6
82 68 8	Pentachloronitrobenzene	$1x10^{-4}$	45	$7.11x10^{-2}$	6
87 86 5	Pentachlorophenol	$1x10^{-3}$	19	$1.4x10^{1}$	6
108 95 2	Phenol	$2x10^{1}$	4	$9.3x10^{4}$	6
298 02 2	Phorate	$7x10^{-3}$	40	$5x10^{1}$	18
1336 36 3	Polychlorinated biphenyls	$5x10^{-4}$	42	$3.1x10^{-2}$	6
23950 58 5	Pronamide	3	4	$1x10^{2}$	1
129 00 0	Pyrene	1	4	$1.32x10^{-1}$	6
110 86 1	Pyridine	$4x10^{-2}$	4	$4x10^{4}$	21
94 59 7	Safrole	$1x10^{-4}$	33	$1.5x10^{3}$	6
7782 49 2	Selenium	$5x10^{-2}$	42		
7440 22 4	Silver	$2x10^{-1}$	4		
57 24 9	Strychnine and salts	$1x10^{-2}$	4	$1.56x10^{2}$	6
100 42 5	Styrene	$1x10^{-1}$	42	$3x10^{2}$	15
95 94 3	1,2,4,5-Tetrachlorobenzene	$1x10^{-2}$	4	6	6
630 20 6	1,1,1,2-Tetrachloroethane	$1x10^{-3}$	5	$2.9x10^{3}$	6
79 34 5	1,1,2,2-Tetrachloroethane	$2x10^{-4}$	5	$2.9x10^{3}$	6
127 18 4	Tetrachloroethylene	$5x10^{-3}$	42	$1.5x10^{2}$	6
58 90 2	2,3,4,6-Tetrachlorophenol	1	4	$1x10^{3}$	6
3689 24 5	Tetraethyl dithiopyro-phosphate	$2x10^{-2}$	4	$3x10^{1}$	25
7440 28 0	Thallium	$2x10^{-3}$	27		
108 88 3	Toluene	1	42	$5.35x10^{2}$	6
95 80 7	Toluene-2,4-diamine	$1x10^{-5}$	45	$4.77x10^{4}$	6
823 40 5	Toluene-2,6-diamine	7	45	$1.3x10^{5}$	1
95 53 4	o-Toluidine	$1x10^{-4}$	45	$7x10^{2}$	1,23
106 49 0	p-Toluidine	$2x10^{-4}$	45	$7.4x10^{3}$ (21°C)	15
8001 35 2	Toxaphene	$3x10^{-3}$	42	$5x10^{-1}$	6
93 72 1	2,4,5-TP (Silvex)	$5x10^{-2}$	42	$1.4x10^{2}$	2
75 25 2	Tribromomethane (Bromoform)	$4x10^{-3}$	5	$3.01x10^{3}$	6
120 82 1	1,2,4-Trichlorobenzene	$7x10^{-2}$	27	$3.0x10^{1}$	6
71 55 6	1,1,1-Trichloroethane	$2x10^{-1}$	14	$1.5x10^{3}$	6
79 00 5	1,1,2-Trichloroethane	$5x10^{-3}$	27	$4.5x10^{3}$	6
79 01 6	Trichloroethylene	$5x10^{-3}$	14	$1.1x10^{3}$	6

**Unverified health-based levels

HEALTH-BASED LEVELS AND SOLUBILITIES
FOR CONSTITUENTS OF CONCERN IN DELISTING PETITIONS
July 1992

CAS No.	Compound	HBL (mg/l)	Ref.	Solubility (mg/l)' (in H_2O at 25°C)	Ref.
75 69 4	Trichlorofluoromethane	$1x10^{1}$	4	$1.1x10^{3}$	6
95 95 4	2,4,5-Trichlorophenol	4	4	$1.19x10^{3}$	6
88 06 2	2,4,6-Trichlorophenol	$3x10^{-3}$	5	$8.0x10^{2}$	6
93 76 5	2,4,5-Trichlorophenoxy-acetic acid (2,4,5-T)	$4x10^{-1}$	4	$2.4x10^{2}$(30°C)	2
96 18 4	1,2,3-Trichloropropane	$2x10^{-1}$	4	$4x10^{3}$	1
76 13 1	1,1,2-Trichloro-1,2,2-trifluoroethane	$1x10^{3}$	4	$1x10^{1}$	6
99 35 4	sym-Trinitrobenzene	$2x10^{-3}$	4	$3.5x10^{2}$	2
126 72 7	Tris(2,3-dibromopropyl) phosphate	$3x10^{-5}$	35	$1.2x10^{2}$	6
7440 62 2	Vanadium	$2x10^{-1}$	45		
75 01 4	Vinyl chloride	$2x10^{-3}$	14	$2.67x10^{3}$	6
1330 20 7	Xylene (mixed)	$1x10^{1}$	42	$1.98x10^{2}$	6
7440 66 6	Zinc	7	45		

**Unverified health-based levels

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EPA

A Guide to Delisting of RCRA Wastes for Superfund Remedial Responses

Office of Emergency and Remedial Response
Hazardous Site Control Division 0S-220

Quick Reference Fact Sheet

On-site CERCLA remedial response actions must comply with the substantive requirements of the Resource Conservation and Recovery Act (RCRA) when they are determined to be applicable or relevant and appropriate requirements (ARARs). RCRA requirements are applicable for CERCLA responses involving the treatment, storage, or disposal of RCRA wastes (or when disposal of the waste being addressed under CERCLA occurred after November 19, 1980). Delisting a RCRA waste (and thus removing it from regulation under RCRA Subtitle C) is one option available to site managers for addressing wastes or treatment residuals containing hazardous constituents in low concentrations (i.e., at or near health-based levels). **This guide discusses the circumstances under which delisting wastes may be appropriate and the procedures for delisting a RCRA hazardous waste as part of a Superfund remedial response.** (For additional information, please see Petitions to Delist Hazardous Wastes: A Guidance Manual (Office of Solid Waste and Emergency Response, April 1985 EPA/530-SW-85-003).)

BACKGROUND

There are two types of RCRA waste that are subject to RCRA Subtitle C hazardous waste requirements: listed and characteristic. Listed wastes are regulated under Subtitle C until they have been delisted, at which time they may be disposed of in a Subtitle D facility. Delisting requires a demonstration that a listed RCRA hazardous waste, or a mixture containing listed hazardous wastes, no longer meets any of the criteria under which the waste was listed and no other factors are known that would make the waste hazardous. Delisting applies only to listed wastes, mixtures containing listed wastes, or residuals derived from treatment of a listed waste. Characteristic hazardous wastes do not have to be delisted in order to be eligible for management in a Subtitle D facility, but may simply be rendered "non-characteristic" (i.e., treated to no longer exhibit any of the characteristics outlined in 40 CFR Part 261, Subpart C), or meet the Land Disposal Restriction (LDR) treatment standards.

For on-site CERCLA remedial response actions, delisting of RCRA wastes is accomplished by incorporating the substantive requirements of 40 CFR 260.20 and .22 into the remedial process. For off-site CERCLA response actions, the administrative requirements of 40 CFR 260.20 and .22 must also be met.

WHEN TO CONSIDER DELISTING

Site managers may want to consider delisting when planning CERCLA response actions that will address materials contaminated with RCRA listed waste in low concentrations (including treatment residuals that, despite treatment, remain listed wastes under the derived-from rule [40 CFR 261.3(c)(2)]). If site managers believe that these materials pose no significant threat to ground water and that management in a Subtitle D solid waste disposal facility (to prevent direct contact) would be fully protective of human health and the environment, delisting as a potential option should be evaluated. Unless listed wastes can be delisted, management of these materials must be in accordance with Subtitle C (i.e., clean closure or landfill closure with an impermeable cap, or a hybrid closure where RCRA closure requirements are relevant and appropriate).

BASIS FOR DELISTING

Under RCRA, once sufficient data are collected on the waste, and its potential fate and transport, models (see **Highlight 1**) are run to evaluate the dilution and attenuation of constituents at a hypothetical receptor well. The calculated concentrations of constituents at the hypothetical receptor well must at least meet the health-based levels used for delisting decisions for the waste to be successfully delisted. (**Table 1**, inserted in this fact sheet, contains the maximum allowed concentrations (MACs) for specific constituents based on the current health-based levels (10^{-6} risk) developed by the Office of Solid Waste for delisting decisions.)

During site characterization and the development of the baseline risk assessment, if analyses indicate that minimal risks are posed by identified RCRA listed wastes, (i.e., they are already at or near delisting levels) site managers should consider management options involving the delisting of wastes. Delisting evaluations should be made early in the RI/FS process, thus allowing the requirements and disposal options associated with delisting to be factored into the detailed analysis of remedial alternatives. For delistings at CERCLA sites, OERR recommends that site managers use the same

Highlight 1 - MODELS USED BY THE OFFICE OF SOLID WASTE TO JUSTIFY DELISTING PETITIONS

The recently promulgated toxicity characteristic leaching procedure (TCLP) is used to measure the leaching potential of selected inorganic and organic constituents (55 FR 11798, March 29, 1990). For some organics, the **Organic Leachate Model (OLM)** (see 51 FR 41084-100, November 13, 1986) may be used to estimate the leaching potential of these constituents. The OLM is based on data from leaching tests performed on wastes with organics. Data generated from the TCLP (and possibly the OLM) are used in the appropriate models to determine whether the waste will pose a threat to human health and the environment.

EPA uses an appropriate model, such as the VHS model, to estimate the ability of an aquifer to dilute the leachate toxicants and predict toxicant levels at a receptor well. (See 50 FR 48846, November 27, 1985 for a complete description of the VHS model.) The predicted levels of toxicants from the VHS model are then compared to health-based levels used in delisting decision-making (e.g., MCLs, RfDs) for those compounds, in an effort to evaluate hazard potential.

analytical tests and models as the Office of Solid Waste to analyze and predict the potential fate and transport of waste constituents and to substantiate a delisting request.

In certain cases, pathways other than ground water may present a greater concern, or site conditions are such that use of other or additional models (e.g., air models, 51 FR 41084, November 13, 1986) may be appropriate. Because the delisting determination is waste-specific, site managers should document why a particular model is being used.

If results from treatability studies conducted during an RI/FS indicate that treatment will attain delisting levels, these data may serve as the basis for approving a delisting demonstration. When site-specific treatability study data are not available, data from the application of technologies to similar wastes may be used to assess the likely effectiveness of the treatment processes and to demonstrate that a particular waste would be rendered non-hazardous and justify a delisting. If there are technically sound reasons to believe that delisting levels can be attained, site managers still may seek to delist the wastes, but should specify another option for disposal of the material (i.e., Subtitle C disposal) if delistable levels are not attained.

As outlined in the NCP (55 FR 8756, March 8, 1990), only the substantive requirements of delisting must be met for on-site CERCLA responses. The delisting may be granted when the Regional Administrator signs the ROD. For off-site actions, the Office of Solid Waste and Emergency Response (Contact: Assistance Branch (OS-343) 382-4206) makes delisting decisions. The formal RCRA administrative process for delisting would not apply, however, to non-contiguous CERCLA facilities meeting the criteria to be treated as one site and to which the on-site permit exemption extends (see NCP, 55 FR 8690-1, March 8, 1990).

DEMONSTRATING COMPLIANCE

Verification testing may be required following treatment of the wastes to confirm that delisting levels are attained. Verification testing may require: collection of samples generated from treatment systems; analysis of samples for total and TCLP leachate concentrations of inorganic and organic constituents, and any other RCRA characteristics (as appropriate)[1]; and analysis of any other information relevant to the delisting that may not have been anticipated at the time that the original decision document was signed. The specific demonstrations required may vary based on process- or waste-specific conditions at the site. [NOTE: An appropriate testing frequency of treatment residuals will need to be established during the design phase for a period long enough to represent the variability of the delisted material.] All data from verification testing must be collected using the appropriate QA/QC procedures (such as those contained in the site's Quality Assurance Project Plan (QAPP) prepared during the RI/FS scoping or remedial design process).

Waste to be delisted must be managed as hazardous until it has been analyzed in accordance with the sampling and analysis requirements established at the time of delisting, and it has been determined that delisting levels have been attained. Therefore, temporary storage of waste residuals will be necessary in some cases until sampling results are received. RCRA storage requirements that are ARAR must be met (or a waiver justified) during this period for remedial actions.

DOCUMENTING A WASTE DELISTING

Although compliance with the RCRA administrative delisting requirements are not required as part of an on-site CERCLA remedial response, compliance with the substantive requirements of delisting must be documented in the appropriate CERCLA documents. Since off-site CERCLA responses must comply with both substantive and administrative requirements, site managers must follow the formal delisting petition process (40 CFR 260.20 and .22) when hazardous wastes or waste residuals are to be delisted for management off-site. This includes Office of Solid Waste review, or State review for those States that have adopted the delisting program at least equivalent to the Federal program, publication of a proposed notice in the Federal Register, an opportunity for public comment, and publication of the final rule in the Federal Register. The Office of Solid Waste's goal

[1]Note that for any responses expected to take place prior to the TCLP effective date, the EP Toxicity test may apply.

Table 1: Maximum Allowed Concentrations

Maximum allowed concentrations (MACs) are back-calculated from the VHS model, using a minimum waste volume of 8000 cubic yards. (Lower waste volumes will result in higher MACs. If the waste contains <0.5% solids, then the leaching procedures cannot be performed. In that case, the total constituent concentrations should be compared to the MACs. These MACs represent the maximum concentrations below which a constituent would "pass" the VHS model, and thus, the waste would be considered a candidate for delisting. These MACs are to be used only as guidance for delisting, not for cleanup levels.

The MACs listed here are based on use of the VHS model and the current health-based levels used for delisting decision-making. If a different model is used and/or if a health-based level changes, then the calculated MAC will also change. The MACs listed here for organic constituents are based on OLM leachate values. In the near future, petitioners may be required to measure organic constituent leaching using the TCLP. (Thus, TCLP leachate data will replace OLM calculated data in the VHS model.) Therefore, if the TCLP is used in place of the OLM for organic constituents, then the TCLP leachate value would be compared to the MAC level listed in the table for liquids.

The numbers shown in the table are given in exponential form. The notation XE+YY is equivalent to X x 10^{YY}. For example: 5.170E+02 is equivalent to 5.170 x 10^{2} or 517.0
3.785E-04 is equivalent to 3.785 x 10^{-4} or .0003785.

Chemical	MAC for Solids (ppm)	MAC for Liquids (mg/L)	Chemical	MAC for Solids (ppm)	MAC for Liquids (mg/L)	Chemical	MAC for Solids (ppm)	MAC for Liquids (mg/L)
Acetone	5.170E+02	2.524E+01	2-sec-Butyl-4,6-dinitrophenol	1.348E+02	2.524E-01	1,2-Dichlorobenzene	4.999E+03	3.785E+00
Acetonitrile	6.231E+00	1.262E+00	Cadmium	6.309E-02	6.309E-02	1,3-Dichlorobenzene	4.790E+04	1.893E+00
Acetophenone	9.049E+03	2.524E+01	Carbon disulfide	1.277E+04	2.524E+01	1,4-Dichlorobenzene	2.650E+02	4.732E-01
Acrolein	1.181E+00	3.15E+00	Carbon tetrachloride	1.408E+00	3.155E-02	3,3'-Dichlorobenzidine	5.656E-02	5.047E-04
Acrylamide	Treat. Tech	Treat. Tech	Chloral	2.840E+00	4.416E-01	Dichlorodifluoromethane	1.063E+05	4.416E+01
Acrylic Acid	3.382E+02	1.893E+01	Chlordane	1.924E+01	1.262E-02	1,1-Dichloroethane	1.140E-02	2.524E-03
Acrylonitrile	3.785E-04	3.785E-04	p-Chloraniline	4.741E+01	6.309E-01	1,2-Dichloroethane	3.717E-01	3.155E-02
Aldicarb	1.253E+00	6.309E-02	Chlorobenzene	1.828E+02	6.309E-01	1,1-Dichloroethylene	1.270E+00	4.416E-02
Aldrin	1.361E-03	1.262E-05	Chlorobenzilate	4.312E+02	4.416E+00	cis-1,2-Dichloroethylene	2.973E+01	4.416E-01
Allyl Alcohol	9.025E+00	1.262E+00	p-Chloro-m-cresol	1.327E+02	1.262E+00	trans-1,2-Dichloroethylene	3.641E+01	6.309E-01
Aluminum Phosphide	6.309E-02	6.309E-02	Chlorodibromomethane	7.825E+02	4.416E+00	Dichloromethane	2.324E-01	3.155E-02
Aniline	2.236E-01	3.785E-02	Chloroform	4.968E-01	3.785E-02	2,4-Dichlorophenol	4.329E+01	6.309E-01
Anthracene	7.701E+01	1.262E-02	Chloromethyl methyl ether	Decomposes	2.524E-05	1,2-Dichloropropane	6.995E-01	3.155E-02
Antimony	6.309E-02	6.309E-02	2-Chlorophenol	4.412E+01	1.262E+00	1,3-Dichloropropene	5.946E-03	1.262E-03
Arsenic	3.155E-01	3.155E-01	Chromium	3.155E-01	3.155E-01	Dieldrin	1.292E-03	1.262E-05
Barium	6.309E+00	6.309E+00	Chrysene	1.516E+01	1.262E-03	Diethyl phthalate	4.795E+05	1.893E+02
Benzene	8.679E-01	3.155E-02	Cresols	1.257E+03	1.262E+01	Dimethoate	8.977E-01	4.416E-02
Benzidine	1.262E-06	1.262E-06	Cyanide	4.416E+00	4.416E+00	7,12-Dimethylbenz(a)anthracene	3.743E-03	6.309E-06
Benz(a)anthracene	9.990E-02	6.309E-05	Cyanogen	1.435E+02	6.309E+00	2,4-Dimethylphenol	1.248E+01	1.262E-01
Benzo(a)pyrene	3.867E-02	1.893E-05	Cyanogen bromide	1.893E+01	1.893E+01	2,6-Dimethylphenol	2.829E-01	1.262E-02
Benzo(b)fluoranthene	1.643E-01	1.262E-04	2,4-Dichlorophenoxyacetic acid (2,4-D)	1.069E+02	6.309E-01	3,4-Dimethylphenol	1.224E+01	2.524E-02
Benzo(k)fluoranthene	7.790E+02	2.524E-02	DDD	6.982E-01	6.309E-04	Dimethyl phthalate	9.232E+06	2.524E+03
Benzyl chloride	8.432E-03	1.262E-03	DDE	9.902E-01	6.309E-04	Dinitrobenzene (mets)	1.317E+00	2.524E-02
Bis(2-chloroethyl)ether	1.893E-04	1.893E-04	DDT	3.109E+00	6.309E-04	4,6-Dinitro-o-cresol	5.127E+01	2.524E-01
Bis(2-chloroisopropyl ether)	2.234E+03	6.309E+00	Dibenz(a,h)acridine	6.554E-02	1.893E-05	2,4-Dinitrophenol	2.296E+01	4.416E-01
Bis(2-ethylhexyl)phthalate	4.210E+01	1.893E-02	Dibenz(a,h)anthracene	7.318E-03	4.416E-06	Dinitrotoluene	1.164E-03	3.155E-04
Bromodichloromethane	7.546E+02	4.416E+00	1,2-Dibromo-3-chloropropan	1.048E-02	1.262E-03	Di-n-octyl phthalate	3.441E+04	3.785E+00
Bromomethane	3.606E+01	3.155E-01	Di-n-butyl phthalate	2.521E+05	2.524E+01	1,4-Dioxane	2.021E-02	1.893E-02
Butyl benzyl phthalate	6.375E+04	5.678E+00				Diphenylamine	1.232E+04	5.678E+00

Table 1: Maximum Allowed Concentrations (cont.)

Chemical	MAC for Solids (ppm)	MAC for Liquids (mg/L)
1,2-Diphenylhydrazine	6.976E-04	2.524E-04
Disulfoton	6.561E-01	6.309E-03
Endosulfan	1.983E+01	1.262E-02
Endrin	1.004E+00	1.262E-03
Epichlorohydrin (1-Chloro-2,3-epoxypropane)	Treat. Tech	Treat. Tech
Ethyl benzene	4.964E+03	4.416E+00
Ethyl ether	2.598E+04	1.262E+02
Ethylene dibromide	6.078E-04	3.155E-04
Ethylene oxide	6.309E-04	6.309E-04
Fluoranthene	2.971E+04	1.262E+00
Fluorene	1.048E+01	1.262E-02
Formic Acid	3.523E+04	4.416E+02
Glycidylaldehyde	7.510E-02	6.309E-02
Heptachlor	3.345E+00	2.524E-03
Heptachlor epoxide (alpha, beta, gamma isomers)	8.346E-01	1.262E-03
Hexachlorobenzene	2.619E-01	1.262E-04
Hexachlorobutadiene	5.139E+00	3.155E-03
Hexachlorocyclopentadiene	8.283E+03	1.262E+00
Hexachloroethane	2.956E+00	1.893E-02
Hexachlorophene	3.131E+03	6.309E-02
Hydrazine	6.309E-05	6.309E-05
Hydrocyanic acid (Hydrogen cyanide)	4.416E+00	4.416E+00
Hydrogen sulfide	6.309E-01	6.309E-01
Indeno(1,2,3,cd)pyrene	2.970E+01	1.262E-03
Isobutanol	8.244E+03	6.309E+01
Isophorone	1.345E+04	4.416E+01
Lead	Under consideration by EPA	
Lindane	1.513E-01	1.262E-03
Maleic anhydride	Soluble	2.524E+01
Maleic hydrazide	9.263E+04	1.262E+02
Mercury	1.262E-02	1.262E-02
Methacrylonitrile	1.479E-01	2.524E-02
Methanol	5.552E+03	1.262E+02
Methomyl	2.743E+02	5.678E+00
Methoxychlor	2.833E+04	6.309E-01
Methyl chloride	8.255E+03	2.524E+01
Methyl chlorocarbonate	1.543E+04	2.524E+02
Methyl ethyl ketone	3.838E+02	1.262E+01
Methyl isobutyl ketone	1.641E+03	1.262E+01
Methyl methacrylate	1.301E+05	1.893E+01
Methyl parathion	1.351E+01	5.678E-02
Naphthalene	5.738E+05	6.309E+01
Nickel	Under consideration by EPA	
Nitric oxide	2.524E+01	2.524E+01
Nitrobenzene	6.557E+00	1.262E-01
Nitrogen dioxide	2.524E+02	2.524E+02
N-Nitroso-di-n-butylamine	2.088E-05	3.785E-05
N-Nitrosodiethanolamine	6.309E-05	6.309E-05
N-Nitrosodiethylamine	1.262E-06	1.262E-06
N-Nitrosodimethylamine	5.611E-06	4.416E-06
N-Nitrosodiphenylamine	1.166E+01	4.416E-02
N-Nitroso-n-propylamine	3.155E-05	3.155E-05
Nitrosopyrrolidine	1.262E-04	1.262E-04
Pentachlorobenzene	2.284E+03	1.893E-01
Pentachloronitrobenzene	7.216E-01	6.309E-04
Pentachlorophenol	2.917E+03	1.262E+00
Phenanthrene	1.398E+01	1.262E-02
Phenol	2.051E+04	1.262E+02
m-Phenylenediamine	1.108E+01	1.262E+00
Phenyl mercury acetate	4.289E-01	1.893E-02
Phosphine	5.803E+00	6.309E-02
Phthalic anhydride	5.788E+05	4.416E+02
Polychlorinated biphenyls	1.223E+01	3.155E-03
Pronamide	5.459E+04	1.893E+01
Pyrene	4.076E+05	6.309E+00
Pyridine	3.364E+00	2.524E-01
Selenious acid	6.309E-01	6.309E-01
Selenium	6.309E-02	6.309E-02
Selenourea	No Solubility	1.262E+00
Silver	3.155E-01	3.155E-01
Strychnine and salts	9.332E+00	6.309E-02
Styrene	2.343E+00	3.155E-02
1,2,4,5-Tetrachlorobenzene	5.603E+01	6.309E-02
1,1,2,2-Tetrachloroethane	5.832E-03	1.262E-03
Tetrachloroethylene	3.430E+00	3.155E-02
2,3,4,6-Tetrachlorophenol	2.992E+03	6.309E+00
Tetraethyl dithiopyrophosphat	6.425E+01	1.262E-01
Tetraethyl lead	1.652E-03	2.524E-05
Thallium	1.893E-02	1.893E-02
Thiourea	1.262E-04	1.262E-04
Thiram	1.918E+03	1.262E+00
Toluene	1.173E+04	1.262E+01
Toluene-2-6-diamine	2.888E+03	3.785E+01
Toxaphene	7.909E+01	3.155E-02
2,4,5-TP (Silvex)	9.905E+00	6.309E-02
Tribromomethane (Bromoform)	9.642E+02	4.416E+00
1,2,4-Trichlorobenzene	1.217E+04	4.416E+00
1,1,1-Trichloroethane	2.229E+02	1.262E+00
1,1,2-Trichloroethane	2.315E-02	3.785E-03
Trichloroethylene	1.146E+00	3.155E-02
Trichlorofluoromethane	8.474E+04	6.309E+01
2,4,5-Trichlorophenol	2.101E+04	2.524E+01
2,4,6-Trichlorophenol	3.536E-01	1.262E-02
2,4,5-Trichlorophenoxyacetic	1.698E+03	2.524E+00
1,2,3-Trichloropropane	1.399E+02	1.262E+00
1,1,2-Trichloro-1,2,2-tri-fluoroethane	1.002E+09	6.309E+03
sym-Trinitrobenzene	5.572E-01	1.262E-02
2,4,6-Trinitrotoluene	3.993E-01	6.309E-03
Vanadium pentoxide	4.416E+00	4.416E+00
Vinyl chloride	1.822E-01	1.262E-02
Warfarin	3.159E+01	6.309E-02
Xylene (mixed)	2.177E+05	6.309E+01

is to propose and finalize delistings within 24 months from the time a complete petition is received.

RI/FS Report

The substantive requirements for delisting a RCRA hazardous waste should be documented in the RI/FS Report. In the Detailed Analysis of Alternatives chapter of the FS Report, a general discussion of why delisting is warranted should be included in the description of each alternative for which a delisting is contemplated. Where the remedial alternatives involving treatment are expected to result in a residual that may be delisted, this discussion should also specify the concentrations of each waste constituent expected to remain after treatment. The specific information that should be included in an RI/FS report for on-site and off-site CERCLA remedial actions is presented in **Highlight 2**. (The more specific and detailed information, such as relevant waste analysis data from sampling, should be placed in an appendix to the report.) Under the "Compliance with ARARs" Criterion, as part of the Description of Alternatives section, site managers should identify those wastes or waste residuals to be delisted, and managed under Subtitle D instead of Subtitle C.

Proposed Plan

The intent to delist wastes should be stated in the Description of Alternatives section of the Proposed Plan. Because the Proposed Plan solicits public comment on all of the remedial alternatives, and not just the preferred option, the intent to delist wastes on-site or to obtain a delisting petition for off-site wastes should be identified for all alternatives for which such an approach is planned. This opportunity for public comment on the Proposed Plan fulfills the requirements for public notice and comment on delisting petitions required under 40 CFR 260.20(d). **Highlight 3** provides sample language for the Proposed Plan.

Record of Decision

Sample language for the Description of Alternatives section of the ROD is shown in **Highlight 4**. The documentation provided in the ROD should be a brief synopsis of the information in the FS report. In the Description of Alternatives section, as part of the discussion of major ARARs for each remedial alternative, site managers should include a statement (as was done in the FS report) that explains why delisting is justified. A statement should

Highlight 2 - DOCUMENTATION FOR RI/FS REPORT FOR DELISTING
(Detailed Analysis of Alternatives Chapter)

ON-SITE:

- Description of Remedial Alternatives
- Detailed Description of the Treatment Process being used to render the waste non-hazardous (e.g., operating parameters)
- Waste and Treatment Residual Characterization
  - EPA Hazardous Waste Number(s)
  - Complete Description of the Waste (e.g., matrix, percent solids, pH)
  - Waste Management Information (e.g., current and proposed management, techniques, flow diagrams)
  - Description of Constituents present (identification, concentrations)
- Relevant Sampling and Testing Information[1] (e.g., TCLP test results)
- Data on Representative Samples for the Listed Constituents and a Discussion of Why the Waste is Non-Hazardous. Include a statement that the samples are representative of constituent concentrations in the waste, and discuss modelling results.
- CERCLA on-site response actions need not meet administrative procedures of other environmental statutes. The RI/FS and ROD process are substitutes for the administrative procedures in the delisting process. The substantive requirements remain the same (55 FR 8756 -57, March 8, 1990).

OFF-SITE (In addition to elements required for off-site petition):

For off-site delisting petitions, the documentation requirements listed for on-site actions should be extracted from the RI/FS report and combined with the following information found below. The information should be incorporated with the on-site information into a 40 CFR 260.20 petition and a copy of the petition should be referenced and attached to the RI/FS report.

- Petitioner's name and address
- Identification of on-site contact person, if different from above
- Description and location of site
- Statement of the petitioner's interest in the proposed action

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[1] Appropriate sampling information may be contained in the Superfund Quality Assurance Project Plan (QAPP) and, therefore, not specifically repeated in the RI/FS Report. Where appropriate, however, information on relevant sampling procedures should be referenced in this section when discussing the basis for delisting.

Highlight 3: SAMPLE LANGUAGE FOR THE PROPOSED PLAN

Description of Alternatives section:

Under this alternative, the [waste/treatment residuals] will be delisted (i.e., shown to be non-hazardous wastes) and thus will no longer be subject to RCRA Subtitle C hazardous waste regulations. The [wastes/treatment residuals] will be managed in accordance with the RCRA Subtitle D (solid waste) requirements (and/or state solid waste disposal requirements).

Evaluation of Alternatives section, under "Compliance With ARARs":

The [wastes/treatment residuals] will be delisted in [Enter number] of [Enter total number of alternatives]. The RCRA Subtitle D (solid waste) closure requirements, rather than Subtitle C requirements, will be ARARs for these [wastes/treatment residuals].

Community's Role in Selection Process:

The Proposed Plan seeks comment on the delisting of the [waste/treatment residuals and models] for each alternative for which delisting is proposed.

Highlight 4: SAMPLE LANGUAGE FOR THE RECORD OF DECISION

Description of Alternatives section:

Because existing and available data and the results of modeling demonstrate that the [waste/treatment residuals] will not be hazardous (i.e., do not contain hazardous constituents in levels that are hazardous and do not exhibit a hazardous characteristic), they will be delisted. Therefore, the RCRA Subtitle C requirements are not ARARs. These [wastes/treatment residuals], however, will be managed as solid wastes under RCRA Subtitle D [and State of {name} solid waste disposal requirements under {citation}]. This delisting is justified on the basis of [results from treatability testing/other basis]. This delisting satisfies the substantive requirements of 40 CFR 260.20 and .22.

If testing of the waste during the remedial action shows that the necessary levels are not being attained for delisting these wastes, they will be managed as Subtitle C hazardous wastes and the applicable or relevant and appropriate requirements under Subtitle C will be met.

also be included explaining that the waste was delisted under CERCLA, therefore RCRA's substantive requirements have been met.

In the Statutory Determinations section, under the "Compliance with ARARs" finding, site managers should indicate that the wastes will be delisted.

Unless treatability studies conducted in the RI/FS indicate that a technology's performance is reasonably certain, the ROD should address how to handle wastes that do not achieve delistable levels. If waste residuals cannot be delisted, a contingency plan will be implemented. Where the contingency implemented differs significantly from that discussed in the ROD, the ROD must be amended or an Explanation of Significant Differences (ESD) issued (NCP §300.435(c)(2)). Where the contingency implemented does not significantly differ from that discussed in the ROD, it may be advisable to issue an ESD or fact sheet to inform the public of these actions.

The Comparative Analysis section of the ROD should discuss contingent remedies in a level of detail that is adequate to explain the contingency (so that the public has an ample opportunity to review the contingency). The Selected Remedy section should establish the parameters of both the selected and contingent remedies and provide the criteria by which the contingency remedy would be implemented. The Statutory Determinations section should demonstrate how either remedy would fulfill CERCLA section 121 requirements.

ATTACHMENT 5
SUPPORTING CALCULATIONS

Below are presented the supporting calculations for the INEL Pit 9 Delisting.

ASSUMPTIONS:

1. 250,000 ft^3 (9,259 cy) to be delisted. The DAF selected is 36 (for 10,000 cy) based on 56 FR 33000 (July 18, 1991). No interpolation to the 9,259 cy as this value is on the non-linear portion of the DAF curve (56 FR 32999).

2. Used scaling factor of 20 (even though waste disposal is a one time event and will not be generated for 20 years). The estimated 250,000 ft^3 for Pit 9 is the expected total volume of wastes to be treated.

3. To determine the Maximum Allowable Leachate (MAL) for NaCN, it was assumed that the leachate would only consist of the CN^- anion and cation weight was not factored in. This resulted in a MAL of 7.2 mg/l, rather than accounting for the cation which would result in a higher MAL (e.g., the MAL for KCN = 18.0 mg/l and the MAL for NaCN = 13.6 mg/l)

4. Health-based levels and solubilities used are from "Docket Report on Health-based levels & Solubilities Used in the Evaluation of Delisting Petitions, Submitted Under 40 CFR §260.20 & §260.22", dated July 1992 (Chichang Chen, EPA HQ provided copy).

CALCULATIONS: Delisting Levels (Assuming a DAF = 36)

CHEMICAL	HBL(mg/l)	Solub.(mg/l)	MAL(mg/l)	C_W(mg/kg)
CCl4	5 x E-3	7.57 x E+2	0.18	18
PCE	5 x E-3	1.5 x E+2	0.18	45
TCE	5 x E-3	1.1 x E+2	0.18	15
1,1,1 TCA	2 x E-1	1.5 x E+3	7.2	2909
NaCN	2 x E-1*	4.8 x E+5**	7.2	122
KCN	2 x E-1*	5.0 x E+5	7.2	119

* HBL = 2 x E-1 mg/l for CN^-
** Solubility for 10 deg. C. vs. 25 deg. C.

EQUATIONS: (from "Use of EPACML for Delisting")

MAL = (Health Based Levels) x (DAF)

Using Organic Leachate Model (OLM) to derive Maximum Allowable Total Concentrations:

$$C_W = \exp\left(\left(\ln(MAL) + 6.1611 - 0.373 \ln S\right) / 0.678\right)$$

Where, C_W = Total Constituent Concentration (mg/l) &
S = Solub. of constituent (mg/l) per 100 cc water